Bacterial Contamination Of The Blood Cockle (*Anadara granosa*)

ISMAIL BIN HAJI ISHAK

Fisheries Research Institute
Department Of Fisheries, Malaysia

Abstract

The contamination of cockles by bacteria of faecal origin was monitored during harvesting, at landing sites, and finally at the retail market. The study was carried out in the three major cockle-producing states of Penang, Perak and Selangor. Cockles from the retail markets were found to be the most contaminated with an average FC-MPN/g count of 177 compared with figures of 62 for harvested cockles and 89 for 'washed'cockles. The state of Penang showed the worst contamination having an average FC-MPN/g count of 242 compared with 119 for Perak and 60 for Selangor. Data from harvesting and landing sites for Penang and Perak showed high contamination levels of FC-MPN/g counts of 318 & 153 and 41 & 118 respectively. However, data from Selangor showed corresponding average FC-MPN/g counts of 17 & 13, figures below the Singapore standard. Basically, results of this study emphasised the need to improve the post-harvest handling of cockles and to depurate them prior to marketing.

Introduction

The cockle industry is a major component of Malaysian aquaculture, contributing about 4% of the total fisheries production in 1989 (Malaysian Fisheries Statistics, 1989). However, this is a decrease from the 11% registered in 1980. In terms of volume, from a peak production of 121,269 mt in 1980, the annual production has decreased to a low of 38,530 mt in 1983 and 39,346 mt in 1989 (Malaysian Fisheries Statistics). The decline in production seems to be correlated to the deteriorating spatfalls in the natural beds over the years (Devakie, 1986). But another reason could be fear of contracting diseases such as gastro-enteritis and hepatitis A which had purportedly been linked to consumption of contaminated cockles (ASEAN Food Handling Bureau, 1984). Such fears had affected export of cockles to neighbouring countries and depressed local demand for the commodity.

The Government of Malaysia immediately retained the services of an expert on depuration of molluscs, through the ASEAN-Australia Programme. The expert helped to set up a pilot-scale depuration plant based on a stack-nesting recirculating seawater system, sterilised by ultra-violet irradiation.

Research and development studies were carried out to determine the feasability of such a system. The results and recommendations following the study have been reported elsewhere (Ismail, 1988).

While R & D were being carried out on depuration of the cockles, a national programme was launched in July 1986 to determine the status of cockle contamination at various points from harvest to washing at landing sites to retail markets. The program continued to June 1987.

Materials And Methods

Cockle Collection

Cockle samples (at least 15 per sample) were collected at weekly intervals from nine sampling stations immediately after they were harvested, eight sampling stations after washing at landing sites and 12 sampling stations from major retail

Table 1. Station codes for various states.

Station code		Station	Code type
PULAU PINANG (P)			
	P1C	Chowrasta Market	C
	P2C	Jelutong Market	C
	P3C	Bukit Mertajam Market	C
	P4A	Kuala Juru	A
	P4B	Kuala Juru	B
PERAK (A)			
	A2C	Ipoh	C
	A2C	Sungei Siput	C
	A3C	Taiping	C
	A4C	Kuala Kangsar	C
	A5A	Kuala Gula	A
	A5B	Kuala Gula	B
	A6A	Kuala Larut	A
	A7A	Bagan Panchor	A
	A7B	Bagan Panchor	B
	A8A	Sungei Kerang	A
	A8B	Sungei Kerang	B
SELANGOR (B)			
	B1C	Kelang	C
	B2C	Pelabunan Kelang	C
	B3C	Selayang, K.L.	C
	B4C	Petaling Jaya	C
	B5A	Sungei Besar	A
	B5B	Sungei Besar	B
	B6A	Kuala Selangor	A
	B6B	Kuala Selangor	B
	B7A	Sungei Burong	A
	B7B	Sungei Burong	B
	B8A	Parit Baru	A
	B8B	Parit Baru	B
	B9C	Banting	C

A = before washing, B = after washing, C = market sample,

markets in the states of Penang, Perak and Selangor, which are the major cockle producing areas (Table 1). The cockles were labelled, transported in ice-coolers and examined within six hours of harvesting at three Fisheries Department Laboratories located within each state.

Bacteriological Techniques

A modification of the ASEAN-Australia technique (Ayres, 1990) was employed. Modified minerals glutamate broth was used in a 5-tube MPN technique with direct incubation into an air oven set at 44 ± 1°C for up to 24 hours. Positive tubes for faecal coliforms were those that changed colour from purple to yellow accompanied with gas production.

Results

Freshly-harvested cockles from Penang showed the highest contamination at a mean of 318 FC-MPN/g compared with 41 and 17 FC-MPN/g for Perak and Selangor, respectively. Cockles 'washed' prior to bagging from Penang again showed the highest level of contamination at 153 compared with 118 and 13 FC-MPN/g for Perak and Selangor, respectively. The contamination at the retail market level was also highest in Penang, being 254 compared with 185 and 109 FC-MPN/g for Perak and Selangor, respectively (Table 2 and Fig. 1). However, data from Penang and Selangor showed a decreasing trend in the contamination levels of cockles which were washed after harvest, having mean FC-MPN/g counts of 153 and 13, down from 318 and 17, respectively. The corresponding FC-MPN/g count for Perak was 118, as compared with 41 for prewashed cockles.

In general, cockles from the retail markets showed the highest contamination at a mean count of 177 FC-MPN/g, followed by 'washed' cockles and 'prewashed' cockles at mean counts of 89 and 62 FC-MPN/g, respectively (Table 2 and Fig. 2).

When the combined data were analysed on a monthly basis, an increasing trend in the mean monthly count was observed for the months of November through to March for the states of Penang and Perak (but not for Selangor), which coincided with the rainy season (Fig. 2).

Table 2. Mean annual counts by station, state and national (FC-MPN/g).

PULAU PINANG		PERAK	
Pa	318 (28)	Aa	41 (139)
Pb	153 (42)	Ab	118 (156)
Pc	254 (130)	Ac	185 (169)
Pav.	242 (200)	Aav	119 (464)
SELANGOR		**NATIONAL**	
Ba	17 (93)	Na	62 (260)
Bb	13 (95)	Nb	89 (293)
Bc	109 (167)	Nc	177 (466)
Bav.	60 (355)	Nav.	122 (1019)

( ) = number of samples
a = before washing
b = after washing
c = market samples
av = average

Discussion And Conclusions

On the whole, cockles from Penang seemed to be the most contaminated, with those from Selangor being the least contaminated. However, except for washed cockles from Selangor, at a mean FC-MPN/g count of 13, the rest of the data indicated that all the samples, whether prewashed, washed or retail market, would not meet the importing standard of Singapore which sets an *Escherichia coli* MPN/g count of 20 (Cheong, 1982), not to mention the more stringent standard of Japan at an FC-MPN/g count of 2.3. The higher level of contamination as shown by the annual mean counts for washed cockles in Perak could be attributed to washing of landed cockles with contaminated seawater. This practice was observed and recorded in places like Kuala Sepetang in Perak where most of Perak cockles were landed

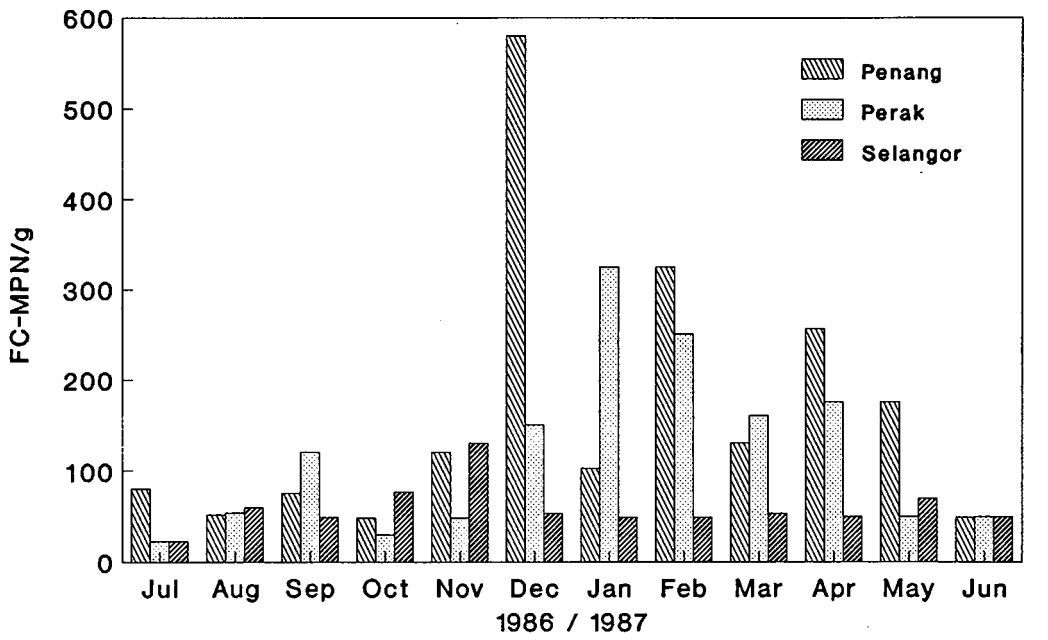

Fig. 1. Bacterial contamination profile of Malaysian cockles - mean monthly FC-MPN/g counts.

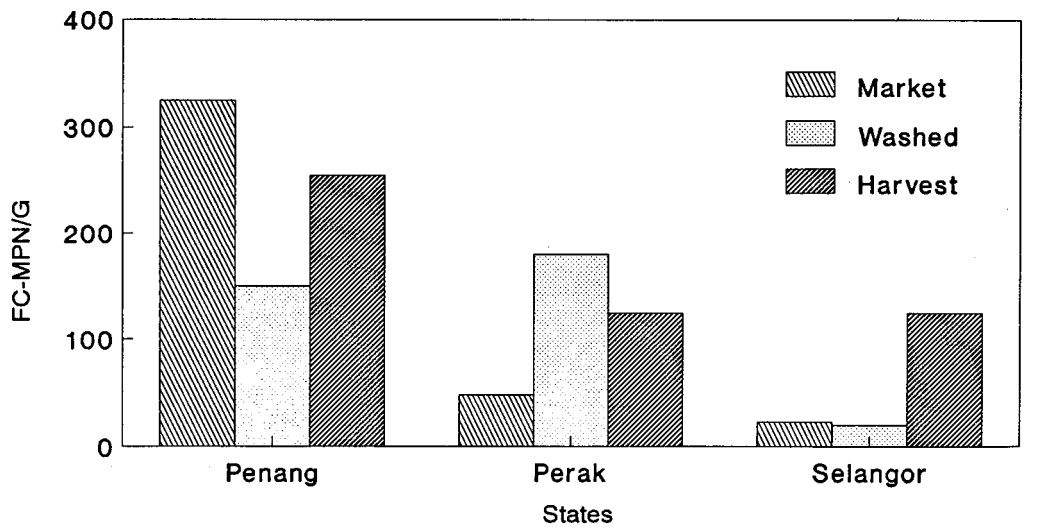

Fig. 2. Bacterial contamination profile of Malaysian cockles - mean FC-MPN/g counts by states and sources.

(see Ayres, 1986). Although this elevated contamination was not observed in Penang and Selangor, detailed analysis on the weekly data showed that there were occurrences of elevated contamination following washing of cockles. That the situation was not reflected on an annual scale might be attributed to factors such as washing possibly having been carried out during periods of high waters. Also, contamination from andropogenic sources were not to the same scale as for Kuala Sepetang. Another possible reason could be that washing was carried out at harvest sites which are commonly contamination-free (Ayres,1986) as is a common practice in Selangor.

Several explanations are possible for the proliferation of faecal coliforms at the market level. It is common for cockles to be bagged in used and sometimes uncleaned fertiliser and bonemeal bags. The cockles are also 'washed' in contaminated seawater before bagging and this might also exacerbate the problem. Proliferation could have taken place during the transportation of the cockles, due to elevated temperatures in the unrefrigerated lorries. Similar proliferation had been reported for mussels transported by lorries in Canada (Blogoslawski & Stewart, 1983).

It has to be pointed out that cockles from the retail markets in the different states did not necessarily come from culture sites from that particular state. There was and still is a considerable movement of cockles from one state to another.

Nonetheless, cockles are shown to harbour quantities of faecal organisms which might pose possible health hazards when consumed raw or semi-cooked - the traditional way of consumption amongst the local Chinese. To satisfy consumer preference, and to protect what is regarded as an important industry, it is envisaged that all cockles regardless of origin would have to be depurated before being marketed.

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Discussion

In reply to a query about the FC-MPN of washing water, Mr Ismail said that the faecal coliform count was very variable and appears to be influenced by the tides.

Asked whether there was a cheap way to depurate cockles, Mr Ismail replied that depuration is an expensive process and that the present depuration system has not been adopted by the industry because of the low wholesale price of cockles. The Government of Malaysia has initiated the establishment of a pilot depuration plant with a 1 mt/day capacity to further promote depuration.

Asked why faecal coliform count was high in December and January, Mr Ismail replied that no study has been conducted to determine the reason. His personal view was that the rainy season could be a factor.

Mr Bremner commented that some studies had shown that mud at the bottom of estuaries tends to absorb bacteria when the salinity is high. During the rainy season, salinity is decreased and bacteria are released.

Mr Santoso commented that in a study of this nature, *Vibrio parahaemolyticus* would also be a meaningful indicator. Mr Ismail replied that at the time this study was conducted, they did not have the facilities to investigate *V. parahaemolyticus*.